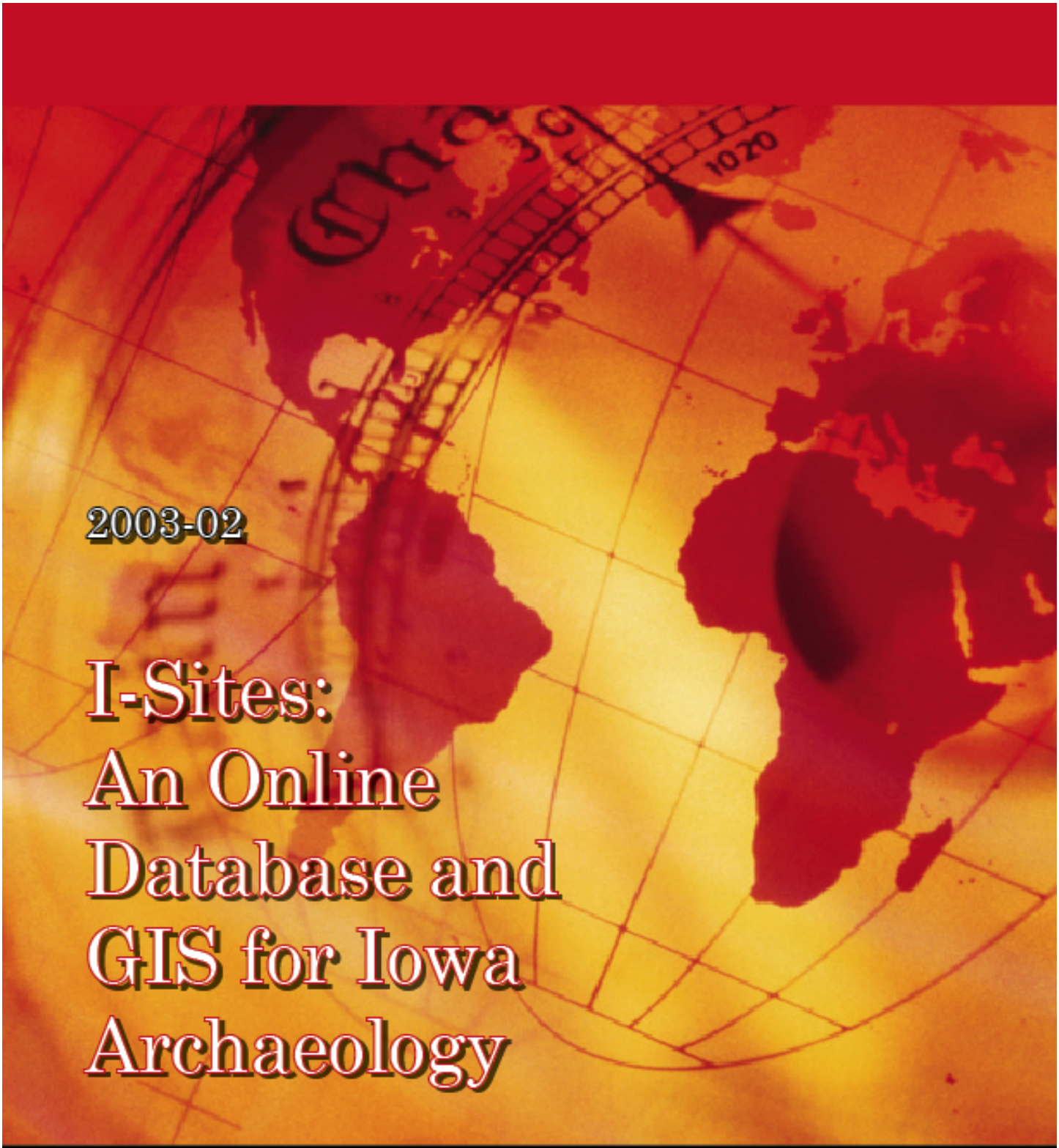

2003-02

I-Sites: An Online Database and GIS for Iowa Archaeology

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I-Sites:
An On-Line Database and GIS for Iowa Archaeology

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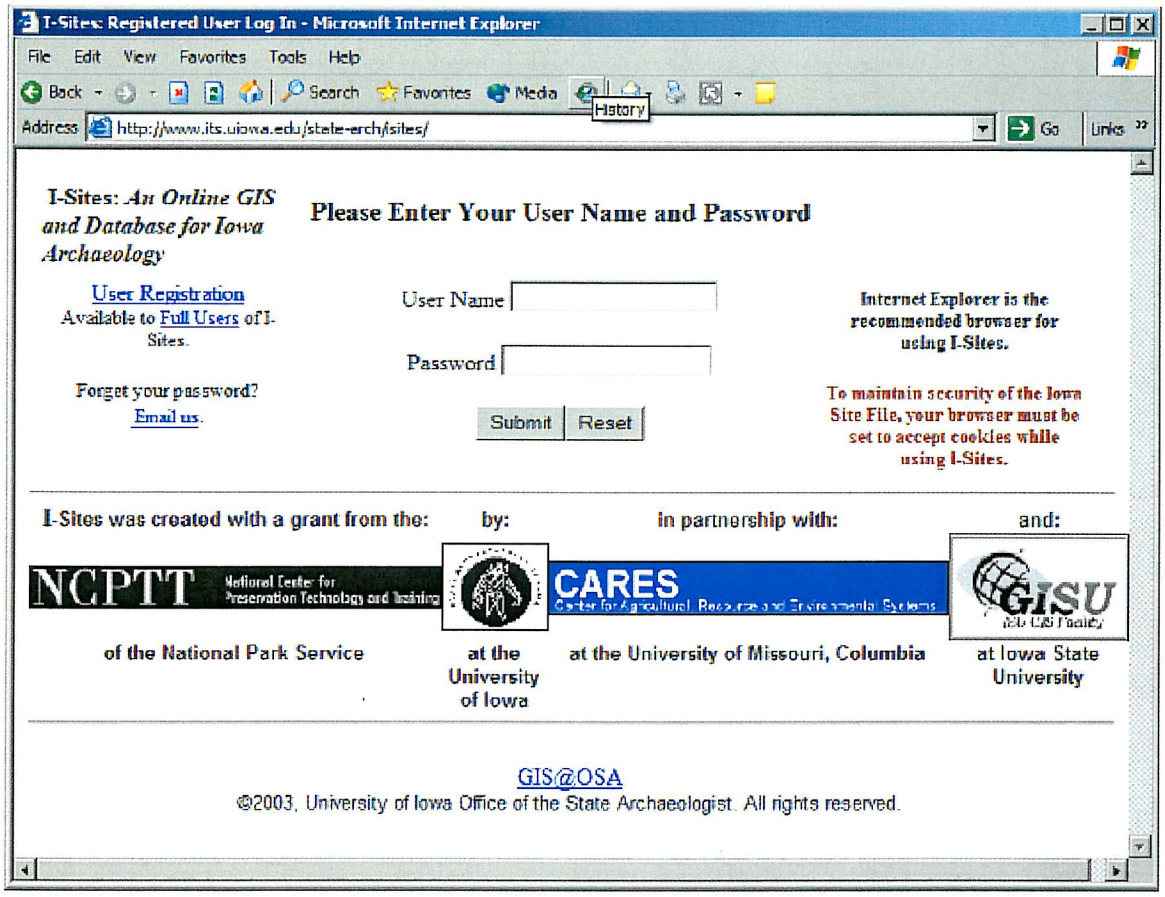
by
Joe Alan Artz



Submitted to
National Center for Preservation Technology and Training
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by
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University of Iowa, Iowa City

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Table of Contents

List of Figures

Executive Summary

The Office of the State Archaeologist at the University of Iowa (UI-OSA) maintains the Iowa Site File, a master inventory of the state's recorded archaeological sites. **I-Sites** is a Web-based, database-driven resource that provides public (unrestricted) and professional (password-restricted) access to the Iowa Site File. This important website was funded by the National Center for Preservation Technology and Training. Development involved a collaboration between UI-OSA, the Center for Agriculture, Research, and Environmental Science at the University of Missouri, Columbia, and the Geographic Information Systems Facility at Iowa State University. The goal of **I-Sites** is to make archaeological data available to all those who need or have an interest in those data, in formats that are accessible with no software other than a web browser. An on-line site form increases the efficiency of recording new sites and makes new information available more rapidly than the earlier, paper-based system. Web-based forms allow users to query the Iowa Site File relational databases. **I-Sites** also features public and professional versions of an Internet Map Server, driven by a Geographic Information System (GIS), that creates interactive maps showing site locations within the state. The public version shows site counts per 1 x 1 mile section. The password-restricted professional version shows actual site locations. Both versions display multiple, user-selected categories of geographic data, including USGS topographic base maps.

The public versions of **I-Sites** went on-line in September 2001. The professional version was gradually phased in as its components were completed between January 2002 and March 2003. A mass e-mailing to Iowa's archaeological community in May 2003 invited professionals to register for the service.

I-Sites contributes to information management in historic preservation in Iowa by resolving the all-too-often-overlooked need to keep preservation-related databases current with existing and ever-growing knowledge. It empowers users to record new archaeological data, giving those who most urgently need the data an active role in keeping it current. It provides government agencies, planners, professional researchers, educators and the general public with current information about Iowa's archaeological record while ensuring the security and confidentiality of the Iowa Site File.

Introduction

Nationwide, thousands of cultural resources are recorded annually. Access to data on archaeological sites is in increasing demand as local, state, and tribal governments assume a more active role in historic preservation planning. Planning needs are met only when information requests are answered by the prompt return of up-to-date information. Relational databases and geographic information systems (GIS), when linked, are a powerful technology for managing information about cultural resources (Farley and Gisiger 1996; Kvamme 1999:162-164; Wheatley 1995). Because preservation planning is almost always undertaken with reference to project areas that have explicitly defined locations and boundaries, GIS offers a particularly powerful interface for visualizing and querying information of relevance to planning (Kvamme 1999:155).

Reviewing information about previously recorded prehistoric and historic sites is an essential first step in any preservation planning effort. The Internet is revolutionizing methods for conducting this basic archival search (Farley and Gisiger 1996). For example, the web site of the Wyoming State Historic Preservation Office <http://wyoshpo.state.wy.us> allows registered users to make a map showing archaeological site distributions within the state. The on-line maps are dynamically linked to Wyoming Cultural Records Office (WYCRO) databases on the sites and on reports of site investigations. A public-access website (www.wygisc.uwyo.edu/atlas) protects the site location confidentiality by displaying only thematic maps of the state showing, for example, numbers of sites per county per cultural period.

Long-term sustainability and accessibility are the principal objectives of **I-Sites,** a Web-based interface for on-line access to the Iowa Site File. The Iowa Site File is a master record of all recorded archaeological sites in the state, maintained by the Office of the State Archaeologist at the University of Iowa (UI-OSA). In addition to paper records and maps, the Iowa Site File includes a relational database of records on individual sites, and a multiple-layer GIS that records site locations.

Prior to **I-Sites**, data from the Iowa Site File could be obtained only by sending a request to UI-OSA staff, by visiting UI-OSA to directly examine the records, or by visiting the State Historical Society of Iowa in Des Moines to examine a copy of the Iowa Site File maintained there. The relational databases and GIS were available only on UI-OSA's local area network and required considerable software expertise to utilize.

Through the 1990s, the Iowa Site File grew rapidly as federally-mandated and publicly funded archaeological surveys resulted in the recording of hundreds of new sites annually (Figure 1a). Accompanying this growth in the amount of data was an increase in the quantity and diversity of requests for data. Driven primarily by federal mandates to comply with historic preservation legislation, increasing numbers of different kinds of public and private enterprises contacted UI-OSA for information about archaeological sites located in proximity to federally-funded or -permitted undertakings (Figures 1b, 2).

Replying to information requests while at the same time keeping the Iowa Site File current with new submissions became increasingly burdensome to UI-OSA's site records staff. The importance of delivering current data to those requesting it was increasingly frustrated by the inability to process new data quickly enough. Many of those requesting data, especially professional archaeologists, were also submitting new data. Other

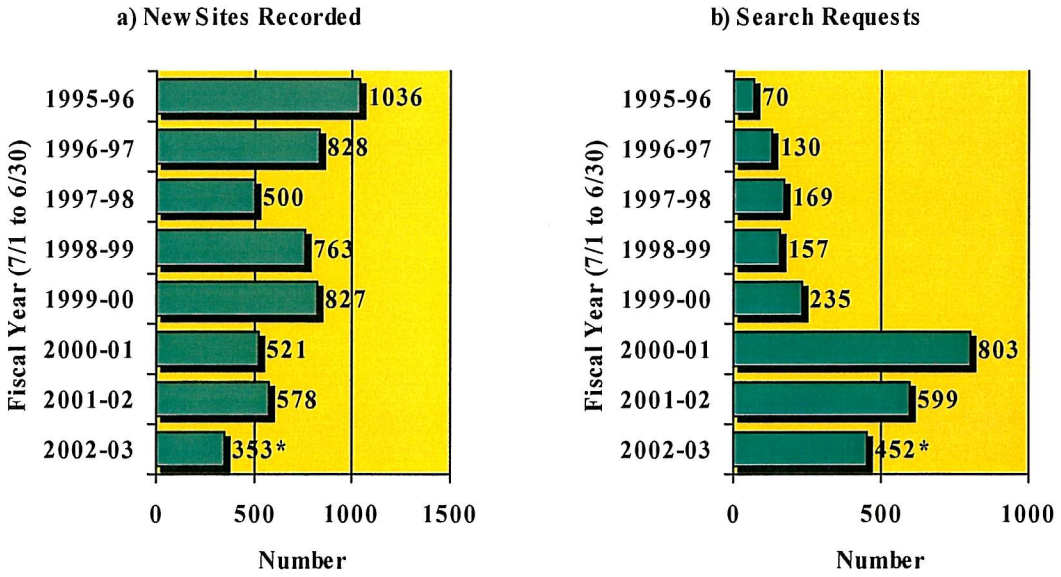


Figure 1. Usage of the Iowa Site File during the past eight fiscal years. Data for FY 2002-03 are complete through 5/23/03.

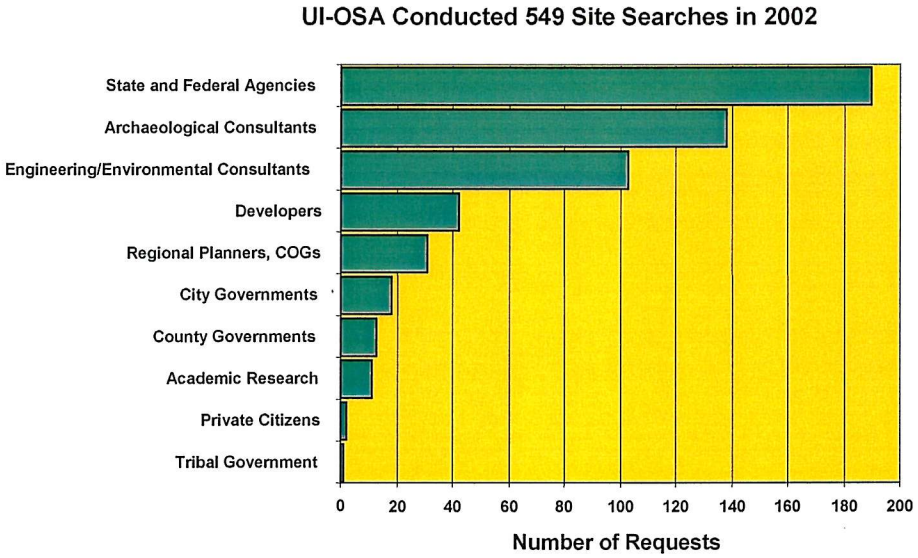


Figure 2. Chart showing distribution of site search requests by client classification for calendar year 2002.

agencies and planners were using the results of searches we provided to recommend archaeological surveys which resulted in the recording of new sites. Simply stated, those demanding current data were also responsible for generating the new data.

I-Sites was envisioned as a solution to this dilemma, serving users the most current data on archaeological sites in Iowa while empowering them to contribute to the currency of that data by on-line submission. **I-Sites** was also envisioned as a way by which access to archaeological data could be extended beyond UI-OSA to include government agencies,

planners, academic researchers, and professional archaeologists, as well as educators and the general public, while ensuring the security and confidentiality of the Iowa Site File.

Partners

As initially proposed to the National Center for Preservation and Technology Training (NCPTT), **I-Sites** was to be a cooperative endeavor of three partners. UI-OSA was to take the lead. The Center for Agriculture, Research, and Environmental Science (CARES) at the University of Missouri, Columbia, was to develop an Internet Map Server (IMS) application for the GIS components of the Iowa Site File. The State of Iowa's Information Technology Department (ITD), based in Des Moines, was to develop a database-driven, Web-based interface for the Iowa Site File's relational databases. In addition, ITD was to eventually house **I-Sites** on a secure Web server.

The involvement of both ITD and CARES was suggested to UI-OSA by Ann Peton, who at the time was Iowa's State Geographic Information Coordinator within ITD. After Peton left ITD in March, 2000, ITD withdrew from the project. UI-OSA subsequently assumed the task of developing a Web interface to link to the Iowa Site File's relational databases. The GIS Facility at Iowa State University, Ames (GISU) agreed to provide a Web server to house **I-Sites**, to transfer the IMS from CARES to GISU and to assist in final implementation.

In addition to the three major **I-Sites** partners, the State Historical Society of Iowa (SHSI) played an important role by providing access to two relational databases that were used to enhance the Iowa Site File. The University of Iowa Information Technology Services (UI-ITS) provided access to a web server on which UI-OSA developed its portion of the **I-Sites** application.

Methods and Materials

The three kinds of materials were used to create **I-Sites**: data, hardware, and software.

Data

Archaeological data from the Iowa Site File are maintained as a relational database using Microsoft Access and in a GIS using ArcView. These datasets are housed on UI-OSA's Local Area Network (LAN) and were distributed to project partners using File Transfer Protocol (FTP) and email attachments.

The Microsoft Access portion of the Iowa Site File consists of tabular information about archaeological sites. Each of the database's 25 tables contains data relating to a particular category of information about sites. One table, for example, records the cultural affiliations of sites, another records site types, another records methods of investigation. Each record in the table refers to information recorded during a single investigation of the site. For example, the first record entered into the database for a site most often contains information about its discovery during archaeological survey. Subsequent records might record information from, for example, additional survey work or excavations conducted at site. The tables comprising the database are linked by a unique Smithsonian Institution Trinomial System site number assigned to the site.

Site locations and boundaries are recorded in the GIS portion of the Iowa Site File. Each recorded archaeological site is represented in the GIS by a polygon the coordinates of which indicate the site's location, in Universal Transverse Mercator coordinates, on

the earth's surface. Each polygon is associated with a record in a data table that identifies the site's unique number. Both the polygon and its associated data table are stored as an ArcView shapefile, a widely-used GIS data format.

In addition to a shapefile of site boundary polygons, the Iowa Site File GIS also includes a shapefile called "IowaSections," that aggregates sites by Public Land Survey (PLS) section. In other words, the number of sites occurring in individual PLS sections (usually about 1 x 1 mile in size) is counted, and that count is attached to the data table for a shapefile containing the 57,000 PLS sections into which the state of Iowa is subdivided. (As of May 2003, 7700 sections contain one or more recorded archaeological sites).

The interactive base maps created as part of **I-Sites** require other layers of geographic data against which archaeological site distributions are displayed. These layers, identified in a subsequent section, were obtained from the United States Geological Survey and the Iowa Department of Natural Resource's GIS library.

Software

UI-OSA used Microsoft FrontPage (versions 2000 and 2002) to develop web pages for **I-Sites**. Pages requiring database connectivity were created using Active Server Pages (ASP) and VBScript (Childs et al. 2000; Kauffman et al. 1999). Among other capabilities, ASP creates dynamic links between a web server and a database. The user, or client, requests information from, or sends information to, the database by making selections from forms displayed by a web browser (e.g., Internet Explorer or Netscape Navigator). The browser sends the information to the Web server, where server-side scripts translate the request into the syntax of Structured Query Language (SQL). The SQL statements, when passed to the database, trigger the appropriate action to retrieve or update records.

ASP pages, stored on the server, contain all the code required to connect to the database, construct SQL statements, and retrieve, add, or modify records from the database. The ASP pages also contain HTML code that sends the retrieved data back to the client-side browser for the user to read. ASP pages form the core of **I-Sites**' "nongeographic" (i.e., relational database) functionality.

CARES and GISU developed **I-Sites**' "geographic interface," or Internet Map Server (IMS), using ArcIMS, a product of ESRI, based in Redlands, California. ArcIMS acts as an interface between GIS data (e.g., shapefiles) and a Web browser. The software interprets instructions about the data layers and map extent requested by the user and returns the requested data to the browser in the form of a raster image.

Both ASP and ArcIMS hide the actual instructions for connecting to databases and GIS files from the user. The only information actually returned from the web server to the user's browser is the HTML that constructs what the browser will display. This prevents the user from learning database and data table names, and from discerning the structure of the databases, all of which is information that might be useful to potential hackers.

Hardware

Most of the work done by **I-Sites** is performed on Web servers. CARES made use of an existing Web server in developing the **I-Sites** IMS. GISU used funds from the present

grant to obtain a similar web server. Server set up including installing and configuring Microsoft Server 2000, SQL Server, IIS web server, Tomcat, and ESRI's ArcIMS.

The nongeographic portion of **I-Sites** was developed and is currently housed on a Windows 2000 Server maintained by the University of Iowa Information Technology Services. This server connects to the Web using Microsoft IIS and has FrontPage extensions enabled.

Results and Discussion

Functionality

I-Sites provides professional archaeologists with four specific functions that are accessed from the **I-SitesPro** main menu (Figure 3). Each function replicates a process that formerly required one-to-one communication between UI-OSA staff and users. **I-Sites** is an extensible application. Each function, and the process it replaces, is described below.

Automated Site Number Assignment

UI-OSA assigns unique numbers to newly-recorded archaeological sites using the Smithsonian Trinomial System. Prior to **I-Sites**, archaeologists contacted UI-OSA by phone or email with reqests for new numbers. UI-OSA staff assigned the numbers from lists contained in three, 3-ring binders, communicated them to the requestor, and subsequently entered the new numbers in an Access Database. The **I-Sites** function Check Out (Figure 3) allows archaeologists to submit a request for site numbers by visiting a web site and completing an on-line form. The web page uses data submitted from the form to query the database to determine the next available numbers and assigns those numbers to the requester. On the Administrative side, a web page was created to monitor the database for new site number requests. The Site Records Manager double checks the request and sends email confirmation to the requestor.

Database Queries

Prior to **I-Sites**, retrieving information from the Iowa Site File often required users to visit UI-OSA and examine the paper site forms filed in four filing cabinets. Users could also make use of copies of the paper forms maintained at the SHSI in Des Moines. Although data from the site forms were entered in a relational database housed on UI-OSA's local area network, the structure of this database was too complicated for most users to query without assistance from Site Records personnel. Site Records personnel occasionally created custom queries and reports at the request of researchers seeking specific kinds of information. By and large, however, photocopying and paper-and-pencil note taking were the primary means by which information from the site file was disseminated.

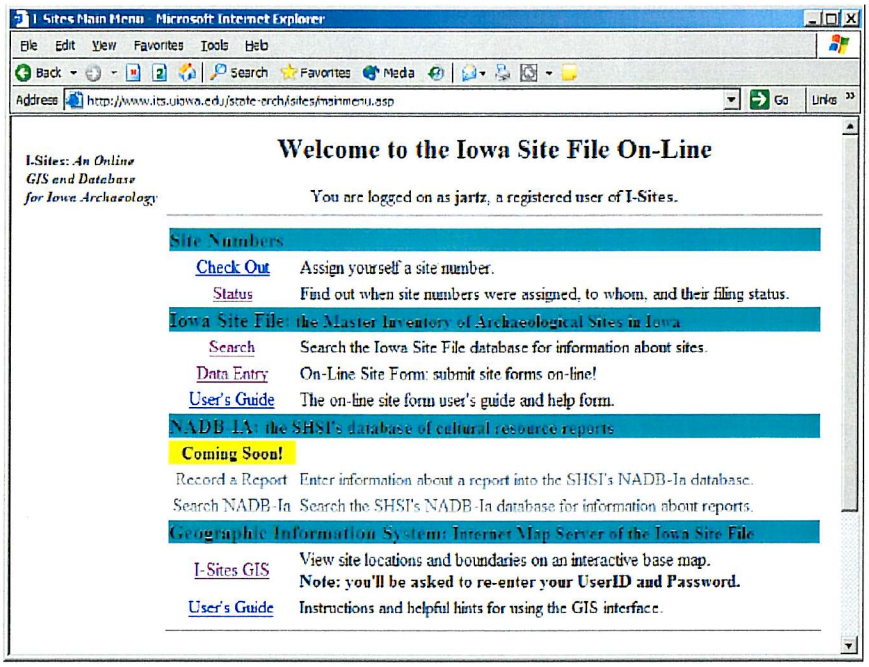


*Figure 3. Screen shot of the main menu of the **I-SitesPro** web site. Each of five major functions (Check Out, Status, Search, Data Entry, and GIS) replicates an existing function of the Iowa Site File that was previously available only by direct communication with UI-OSA staff.*

Two **I-Sites** functions, Status and Search, permit users to query the Iowa Site File database. Web forms allow users to select data tables and fields, and to specify search criteria. The Status function allows the user to determine when and to whom specific site numbers were assigned and whether a site form is on-file for the site (Figure 4). The Search function allows users to query the database for information recorded about individual sites such as cultural affiliation, site type/function, and dates investigated (Figure 5).

Data Entry

Prior to **I-Sites**, information about archaeological sites was reported to UI-OSA on paper forms. Even after the introduction of a Microsoft Word version of the form, information from the forms still needed to be entered manually into the Iowa Site File database, and the forms had to be printed, filed, and copies mailed to SHSI.

The Data Entry function of **I-Sites** allows password-restricted access to web pages that allow users to complete an electronic version of the site form on-line. The greatest advantage is the reduced time lag between data submission and their availability in the Iowa Site File. In addition, UI-OSA staff are able to spend less time on data entry and more time on quality-assurance of the submitted data.

The on-line data entry form follows an "interview" process in which the user progresses through a series of steps from identifying a site number and investigation date, to checking, revising, and final filing. **I-Sites** tracks data entry progress, and enables users to skip from section to section if they wish and also to postpone a data entry session to be resumed at a later time (Figure 6).

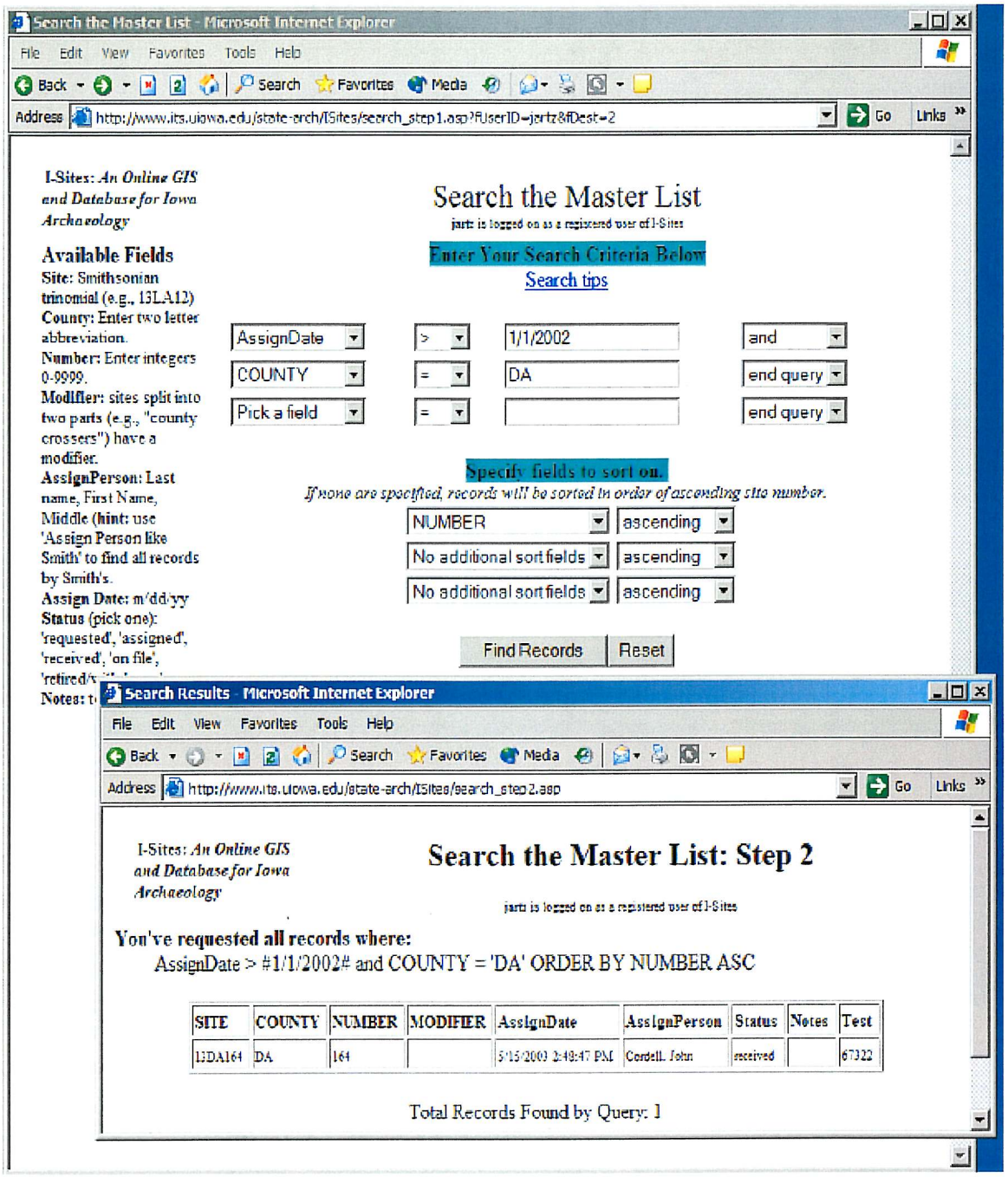
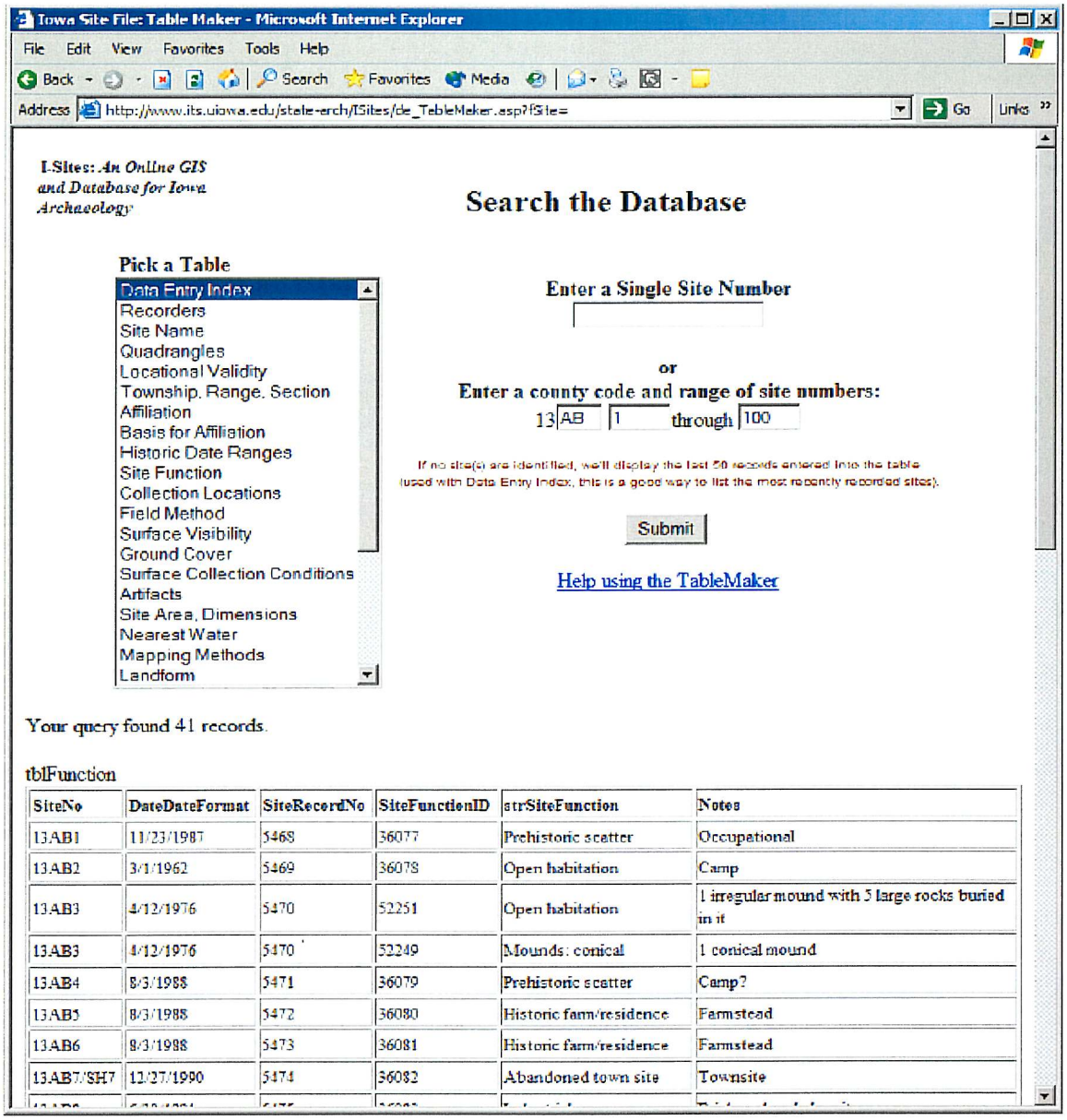


Figure 4. Screenshot illustrating the I-Sites Status function. The query, in the upper window, requests all site numbers assigned in Dallas county since 1/1/2002 (AssignDate > 1/1/2002 and COUNTY = DA). The lower window displays the one record, for 13DA144, that meets these criteria. The date and person to whom the site number is assigned are indicated. The Status field indicates that a form has been received for this site, but has not yet been checked and verified by UI-OSA staff.



SiteNo	DateDateFormat	SiteRecordNo	SiteFunctionID	strSiteFunction	Notes
13AB1	11/23/1987	5468	36077	Prehistoric scatter	Occupational
13AB2	3/1/1962	5469	36078	Open habitation	Camp
13AB3	4/12/1976	5470	52251	Open habitation	1 irregular mound with 5 large rocks buried in it
13AB3	4/12/1976	5470	52249	Mounds: conical	1 conical mound
13AB4	8/3/1988	5471	36079	Prehistoric scatter	Camp?
13AB5	8/3/1988	5472	36080	Historic farm/residence	Farmstead
13AB6	8/3/1988	5473	36081	Historic farm/residence	Farmstead
13AB7/SH7	12/27/1990	5474	36082	Abandoned town site	Townsite

Figure 5. Screenshot illustrating a database search. The "Pick a Table" drop down list at upper left displays the available data tables. Each table contains a single category of information that is available in the database. The user selects a table, then enters a single site or list of sites. In this example, the Site Function table is displayed for sites 13AB1 through 13AB100. Scrolling down would bring into view additional records.

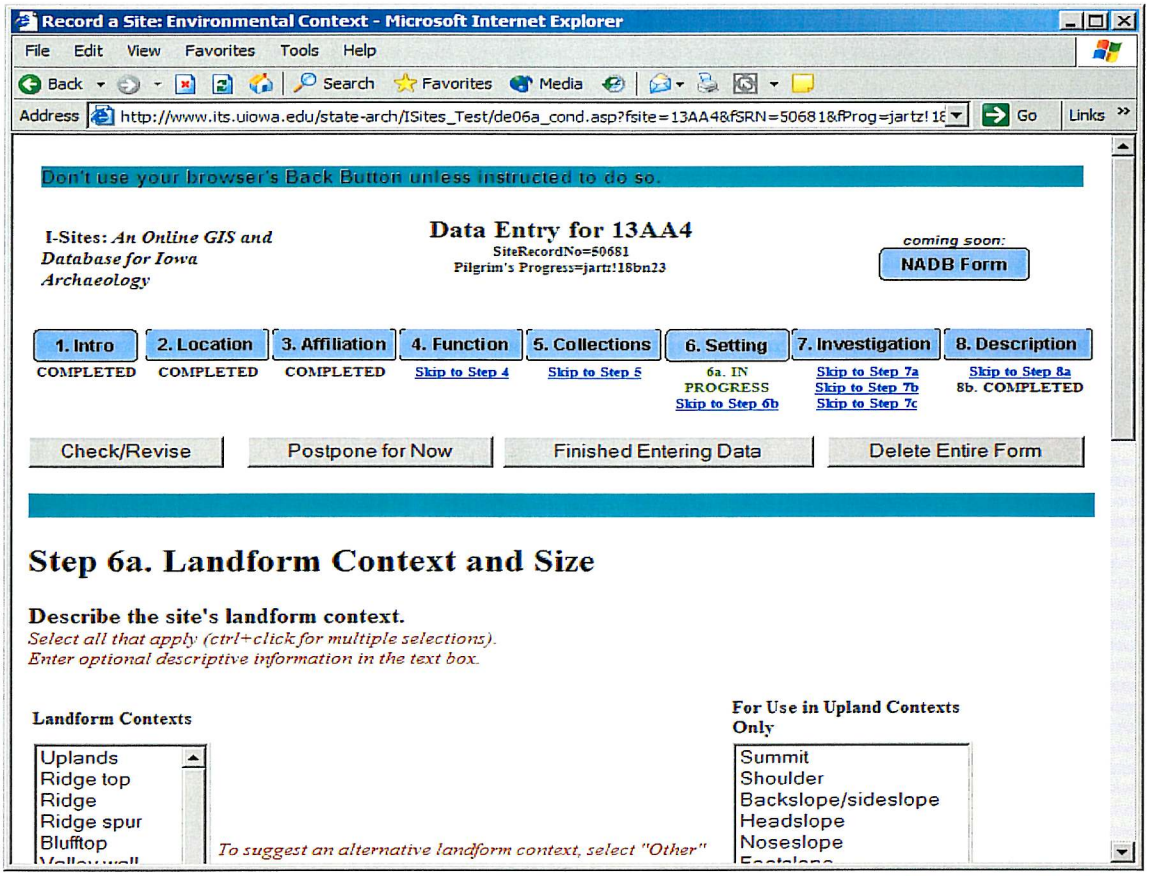


Figure 6. Screenshot illustrating the on-line site form in action. The navigation and status bar in the upper part of the screen indicates that Steps 1 through 3 and Step 8b have been completed, and that Step 6a is in progress. The lower part of the screen contains web forms in which the user enters data.

Internet Map Servers (IMS).

Prior to **I-Sites**, the only reliable way to determine site locations from the Iowa-Site File was to examine maps stored at UI-OSA or SHSI. Maps of varying quality were attached to some individual site forms in the filing cabinets. All site locations were plotted on a set of nearly 1000 USGS 7.5 minute quadrangles. Photocopying from the quadrangles was the principal method of disseminating locational information.

During 1999 and 2000, UI-OSA digitized all site locations from the paper quadrangles into a GIS (Artz 1999). The locations were exhaustively checked against the site forms and databases. Many misplotted and previously-unplotted sites were discovered and corrections made. The GIS data were available, however, only on the UI-OSA LAN.

For **I-Sites**, three IMS applications were developed. The first of these, developed at CARES, provided internet access to site locations aggregated by PLS sections, typically 1-mile square (Figure 7). No restrictions are placed on access to this IMS. A second IMS application was developed at GISU. This application allows password-protected access to

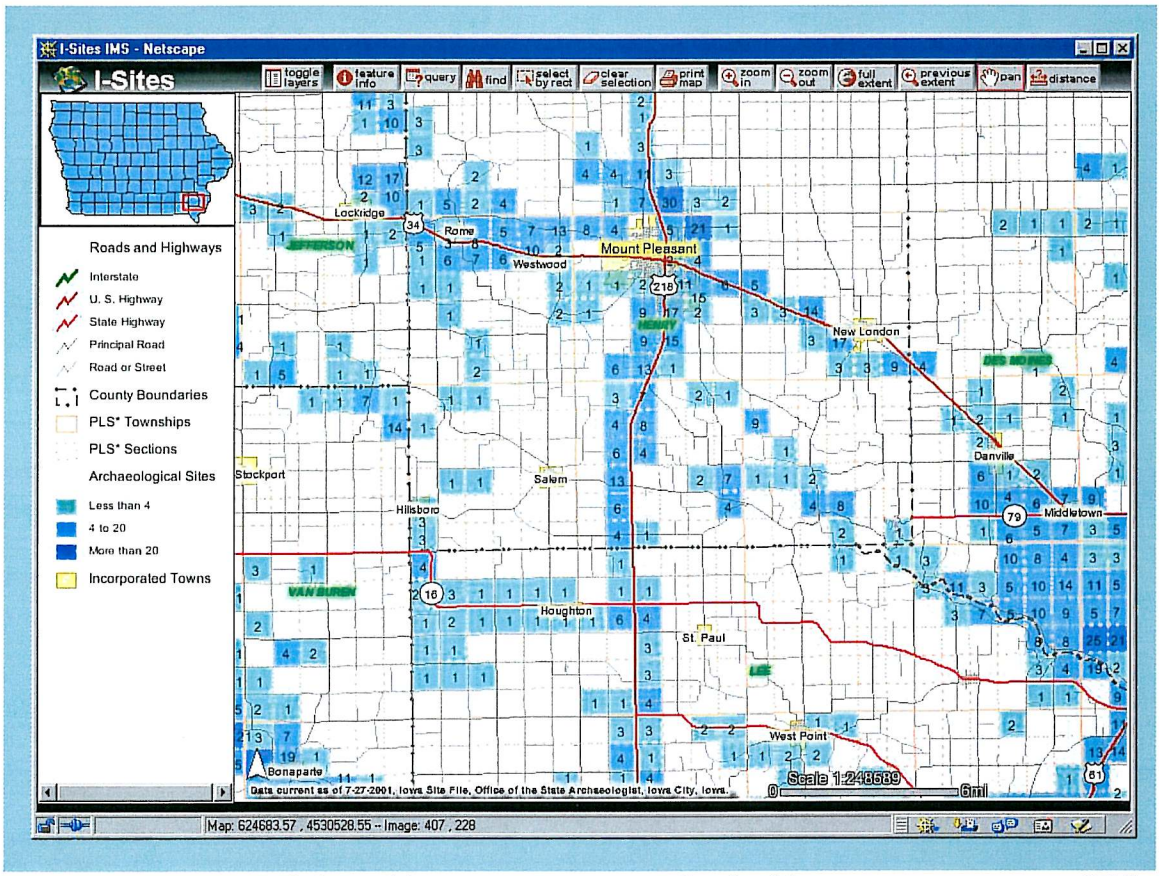


*Figure 7. Screenshot of the public access **I-Sites** IMS. The blue squares represent PLS sections where archaeological sites are recorded. Sites counts are indicated by number labels, and by depth of shading. Zooming closer allows the section map to be displayed on a base map of USGS quadrangles.*

actual site locations, represented as polygons. A third IMS, developed at CARES, was an attempt at on-line digitizing. Scripts captured the user's mouse clicks, translated them into map coordinates, and compiled them into an ESRI shapefile that was delivered to UI-OSA as an email attachment.

All three applications provide archaeological data in the form of an interactive map that permits the user to selectively display, annotate, and query the following data layers:

- Counties
- Incorporated Towns
- Roads and Highways
- Watershed Boundaries
- PLS townships
- PLS sections
- USGS 7.5 minute (1:24,000) quadrangle boundaries
- Digital raster graphics (DRGs) of United States Geological Survey quadrangles at 1:250,000, 1:100,000, and 1:24,000 scales.

Implementation

IMS Application ("Geographic" Interface).

The IMS application for unrestricted access was the first **I-Sites** component to be developed and go on-line. This initial version of the IMS, which was published to a CARES web server in September, 2001, displayed archaeological site locations only to the nearest PLS section, a level of map detail that we judged would provide useful information while not revealing specific site locations. Tabular data linked to the archaeological map data included the number of sites in each section, and whether the site was assigned to prehistoric, historic, or unknown time periods. UI-OSA announced the URL to the Association for Iowa Archaeologists listserv on November 10, 2001, and invited comments. Comments documented satisfaction but also identified problems areas that resulted in improvements to the interface. The most serious of these involved browser compatibility problems, with ArcView IMS not being supported by older browsers, and providing suboptimal functionality with Netscape Navigator. The latter problem was overcome with alternative scripting that permitted Netscape users to make full use of the IMS functions.

Once completed, UI-OSA encouraged use of the IMS by nonarchaeologists, including developers, planners, and the general public. UI-OSA periodically sent CARES updated shapefile data so the IMS would reflect the most current available data on site locations in Iowa.

In May 2002, following the installation of an appropriate server at GISU, the unrestricted-access IMS was transferred from CARES to GISU, where it has been housed since that time. A link to the IMS is maintained on UI-OSA's web site at <http://www.uiowa.edu/~osa/gisatosa>.

In July and August, 2002, CARES created a pilot version of a password-protected IMS. Dubbed **I-SitesPro**, this map service provided actual site locations and boundaries, as opposed to site counts aggregated by PLS section. In **I-SitesPro**, display of site boundaries is dependent on map scale. At scales between 1:100,000 and 1:24,000, the IMS displays site locations as points (Figure 8a). Zooming in closer, to scales larger than 1:24,000, the actual site polygon boundaries become visible (Figure 8b). The sites can be viewed against a base map of USGS quadrangles. At scales from 1:100,000 to 1:24,000, the 1:100,000 quad series is displayed. At scales of 1:24,000 to 1:10,000, the 1:24,000 quads are displayed.

CARES was also charged with the task of developing tools for on-line digitizing. As envisioned in our proposal to NCPTT, these tools would allow users to digitize polygons by clicking on a base map displayed by their web browser. The browser would send the coordinates of the clicked points to the web server, where server-side scripts would compile the point sets into a polygon shapefile. The shapefile would then be uploaded to UI-OSA, and would comprise on-line submission of map data to the Iowa Site File. CARES had previously developed on-line digitizing tools for their "Map Room," a web application serving geographic data for the State of Missouri <http://maps.cares.missouri.edu/maproom>. These tools were developed to work with ArcView IMS, an early version of IMS software, and were not compatible with the current ArcIMS software. In July 2002, a redesigned on-line digitizing tool was added to the **I-SitesPro** interface by CARES and was tested by UI-OSA and selected professional

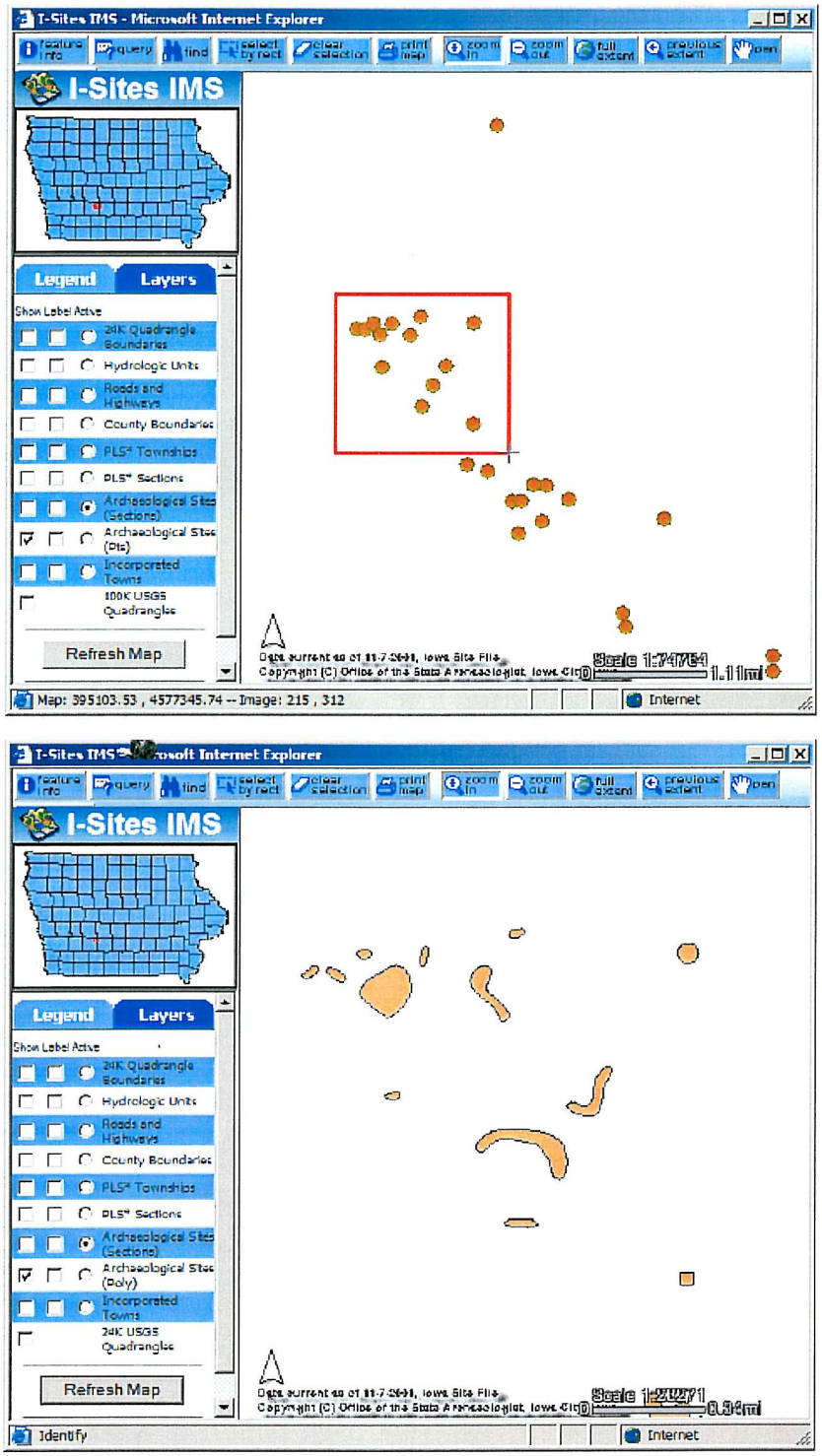


Figure 8. ***I-SitesPro*** *IMS screenshot. At scales of 1:100,000 to 1:24,000, sites are displayed as points (top). Here, the user has clicked "zoom in" on the button bar at top, and has drawn a red rectangle enclosing a cluster of sites. Bottom: Releasing the mouse button zooms in to this site cluster. At scales closer than 1:24,000, actual site boundaries are displayed, as shown at bottom. In either view, clicking the radio button for USGS quadrangles at lower left, followed by Refresh Map, would display a quadrangle base map. Base map layers are not shown in this figure to protect location confidentiality.*

archaeologists. Testers found the tool difficult to use, particularly if they lacked experience digitizing in a GIS environment. In addition, it seemed likely that future releases of ArcIMS would provide improved, "out-of-the-box" support for on-line digitizing. UI-OSA therefore decided to not proceed with development of the digitizing tools.

In November 2002, GISU added password authentication to the **I-SitesPro** IMS. A system was established whereby UI-OSA maintains a master user registration database that is kept synchronized with a copy of the database at GISU. **I-SitesPro** was first made available to the archaeological community in January 2003.

Database Application ("Nongeographic" Interface)

In January, 2002, OSA placed the first component of **I-Sites**' nongeographic interface on line. This component allowed users to assign themselves new site numbers using the World Wide Web. In Iowa, as in most states, sites are numbered using the Smithsonian Trinomial System in which the first two characters are a numeric code for the state (Iowa is "13"), the next two characters are a two-letter code for the county name (e.g., "AM" is Allamakee County), and the final characters are a unique number for the site within the county, beginning with 1 and continuing, most often, in the sequence in which they are generated. The Site Number Checkout web pages ask the user to identify the number of site numbers requested for a given county, then query a database to determine the next available number for that county, and add records to the database assigning new numbers to the user. The webpage then generates an email to the user acknowledging the request.

In the process of developing the site check out form, a web database was created allowing users to query individual site numbers to determine when and to whom the numbers had been assigned. This database query functionality, called Status, went on-line January 18, 2002.

UI-OSA developed an on-line form for data entry between December 2001 and August 2002, when GIS@OSA staff began using the web pages exclusively for all site form data entry. The data entry form was also made available to selected members of the professional community for beta testing at this time. Initial use led to extensive improvements and the release of a second version in November 2003. Version two included greatly improved correction/revision functions and limited printing capabilities. A third version, released January 2003, included enhanced security features including user authentication on each page and a continually-updated user log to track user log-ins and their progress through the site.

A web page for querying the Iowa Site File database was created early during development of the on-line site form. The first version simply displayed the last 10 records entered in any table in a test version of the database, and was intended solely to allow the web developer to determine whether data entry web forms were being correctly stored in the database. A second version, created in November 2002, added form-based queries that allowed users to retrieve records for either a single site number, or a range of site numbers. The third and current version of the database query pages, released March 2003, added user authentication checks.

Administration

In the process of developing on-line forms for data entry and querying, web pages were developed for administrative use by OSA staff. Since March 2002, nearly all administrative tasks involving access to, and modification of, the Iowa Site File databases has been accomplished through a web interface. Presently, the databases are opened in Microsoft Access only to conduct complex, customized queries and to modify data table structure and relationships.

The administrative page allow I-Sites administrators to perform quality checking and quality control on site data submitted via the World Wide Web. The most common data quality issues involve instances in which users inadvertently assign themselves more site numbers than they actually intended, in which case records for the "unused" numbers need to be deleted.

In developing **I-Sites**, UI-OSA spent considerable effort simplifying and streamlining the Iowa Site File database structure. Several tables were eliminated or combined with other tables, overly-complicated relationships among tables were simplified, and erroneous and ambiguous lookup values for some data categories were corrected. Presently, about 80 variables, stored in 25 tables, are collected by the on-line site form and stored in the Iowa Site File database, and all are accessible via the Search function.

As the various components of **I-Sites** came on line, it was necessary to restrict access via password-protection to registered users. A policy for establishing criteria for qualifying to use the service was developed. To qualify as a registered user, a person must meet one or more of the following criteria:

- a member in good standing of the Association of Iowa Archaeologists <http://www.uiowa.edu/~osa/aia>;
- listed on, or an employee of a person or firm listed on, the SHSI's List of Prehistoric and Historic Archaeological Consultants <http://www.iowahistory.org/preservation/review_compliance/106_consultant_list.html>;
- qualified under the Secretary of the Interior's Standards and Guidelines for Archeology and History Preservation (36 CFR Part 61; <http://www2.cr.nps.gov/laws/ProfQual83.htm>).

A registration database was created along with web pages for interacting with the database. A copy of the database is maintained by GISU for authentication of the **I-SitesPro** IMS application.

I-Sites administrative staff were the first to receive user ids and passwords, followed by OSA-approved beta testers from the Iowa archaeological community. In May 2003, an open letter was emailed to 146 potential users of **I-Sites**. These include the membership of the Association of Iowa Archaeologists, individuals and firms on the SHSI's Consultant's List. The open letter invited these individuals to register as full users of **I-Sites**.

Security

The Iowa Site File contains locational information on culturally sensitive, historically significant, and therefore irreplaceable heritage resources. To ensure the protection of these resources, the State Archaeologist has statutory authority under Iowa Code section 305A.10 to restrict access to locational information. Several steps have been taken to ensure that **I-Sites** affords this level of protection. First, the unrestricted-access portions

of **I-Sites** provide no locational information more specific than the number of sites per PLS section. Most Iowa archaeological sites are so small that revealing their location to the PLS section reveals nothing about, and therefore maintains the confidentiality of, their specific location.

Specific site locations and boundaries are provided only in the password-protected areas of **I-Sites**. To gain access to **I-SitesPro**, users must first apply to UI-OSA for a user name and password. Individual log-ins are validated against a database of registered users before the home page loads. Most pages linked from the **I-SitesPro** home page, and all pages that connect to the actual database, begin with a re-authentication check before the user is allowed to view the page.

The Iowa Site File database is stored on the Web server in a folder that is invisible to Web browsers. This folder can be accessed only by UI-OSA staff who have been granted administrative or authoring privileges.

The IMS applications at GISU are also protected by a database-driven user authentication system. When first entering the **I-SitesPro** IMS, users are required to authenticate themselves by re-entering their **I-Sites** user name and password. The information entered is checked against an Access Control List (ACL) in a database. The ACL database at GISU is synchronized with UI-OSA's registration database via an Object-Oriented Database Connection (ODBC). Use of an ACL allows UI-OSA to maintain control over users and for what period of time a user can have access to the restricted archaeological data.

The **I-SitesPro** IMS is also protected by using an aliased servlet. A servlet is a server-side program that is used in building interactive Web sites. In the standard installation of ArcIMS, all map services are accessed through a common servlet container, which acts as a connector between the web client (i.e., the user's browser) and the ArcIMS application server. This common servlet is visible to, and accessible freely from, anywhere on the Internet. In order to make **I-SitesPro** less visible to users, a second servlet was created. Requests for the **I-SitesPro** map services are redirected to this aliased servlet rather than going to the standard ArcIMS servlet location. This redirection occurs on the web server and is thus invisible to the user. This prevents clients other than web browsers from seeing the **I-SitesPro** map services.

Long Term Management Plan

A management plan executed between UI-OSA and GISU outlines the responsibilities of each organization in maintaining **I-Sites**. UI-OSA's responsibilities include uploading new data, maintaining the registered users database, developing a fee structure for **I-Sites** maintenance costs, maintaining a home page for **I-Sites**, monitoring and responding to user feedback and maintaining web pages for the nongeographic (relational-database-driven) interface. GISU's responsibilities include maintaining hardware and software for the geographic (IMS) interfaces, maintaining user authentication with UI-OSAs registered users database, and providing security on the GISU webserver for site location data. Under the management plan, UI-OSA and GISU share responsibilities for monitoring use of **I-Sites** and making strategic improvements to hardware, software, and the web interfaces. The management plan is subject to an annual review and revision by both partners.

Announcing I-Sites

A press release announcing the beginning of **I-Sites** development was distributed to newspapers and radio stations throughout Iowa in October 4, 2000. The press release was prepared by UI-OSA and the University of Iowa News Office with content approval by NCPTT.

Two interim presentations on **I-Sites** development were given. Artz (2001) reported on **I-Sites** to an international symposium on GIS in archaeology held at the Argonne National Laboratory. Artz and Eck (2001) gave a more detailed presentation on **I-Sites** to the Iowa Geographic Information Conference, a statewide gathering of GIS professionals ato IGIC. In addition, **I-Sites** received attention in the Summer 2002 issue of *GIS Educator,* a newsletter issued by ESRI, a leader in the GIS industry (Booth 2002).

I-Sites will be announced as a finished, NCPTT-funded product at the 2003 meetings of the Association of Iowa Archaeologists, the Plains Anthropological Conference, and the World Archaeological Conference (Artz and Eck 2003). These presentations will reach statewide, regional, and international audiences, respectively. A second press release is also planned for June 2003.

Conclusions

Prior to **I-Sites**, UI-OSA had developed a reliable system for assigning new site numbers and managing both locational and database information that comprise the Iowa Site File. From the outset, we viewed **I-Sites** as a system that would not replace the paper-driven system, but simply translate or transfer it to a web-based one. We viewed the Web as a tool for extending the existing functions of the Iowa Site File. It is possible to relate each hyperlink on the **I-Sites** homepage to its paper counterpart in the Site Records area of UI-OSA. "Check Out" and "Status," for example, have their paper counterparts in a set of three, black, 3-ring binders where lists of numbers assigned in each county were formerly written. "Data Entry," the on-line site form, has its counterpart in the paper site forms and their Word-document successors that were formerly mailed to UI-OSA to be manually entered (i.e., retyped) into the Iowa Site File. "Database Search" has its counter part in four, four-drawer filing cabinets that contain the paper copies of site forms, and the GIS-driven IMS's have their counterpart in the wooden map case that contains 950-some paper 7.5 minute quadrangles where site locations were plotted.

I-Sites, of course, not only translates but also considerably extends the functionality of the Iowa Site File. For example, using the **I-SitesPro** IMS, it is possible to view site locations on multiple USGS quadrangles at once, something that previously required the laborious cutting-and-pasting of multiple photocopies. Using the **I-Sites** database Search function, it is possible to retrieve and view records for multiple sites at once, a task that previously required flipping through and taking notes from multiple pages and multiple books in the paper site forms. These are only two examples of how, in the final analysis, **I-Sites** has begun to exceed our initial expectations by not only replacing, but also improving, the services offered by the Iowa Site File.

UI-OSA continues to keep paper documentation of sites, survey areas, and locations; however, new data goes first into the database and the GIS, and only later, as the final step in the data entry process, onto paper. We continue to do this to serve those in the

cultural resource community who are not quite ready to embrace the **I-Sites** way of accessing the site file.

Short-term plans for improvements to **I-Sites** include (a) integrating the NADB-Iowa survey coverage data into both the IMS and Web database components of **I-Sites**. This task is already in progress and will hopefully be completed by September 2003. Another short term goal is the creation of an on-line search request form to take the place of the current Word-based form that is currently delivered by e-mail.

A web site is never finished. Its layout and organization can always be improved. Scripts can always be rewritten to improve performance and readability. New functions can be added and existing functions enhanced to reflect user feedback and technology enhancements. The following improvements are planned:

- Add archaeological survey areas to the **I-SitesPro** IMS 2003
- Add black and white aerial imagery, in the form of digital orthophoto quads to both IMS's. 2003
- On line queries and data entry for Iowa's version of the National Archaeological Database. 2003
- On-line site file search request form 2004
- Migration of databases from Microsoft Access to SQL Server 2004

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